20

TELECOMMUTING

Definition:

This measure assumes that Pennsylvania employers will make liberal use of telecommuting among their employees, wherein the employee could work at home using modern telecommunications hookup and avoid a physical trip to the central workplace on one or more days per week.

An effort was made to define the application of this measure such that its impacts would be in addition to those attributable to telecommuting as a part of TCM 17 (ETRP). Thus, the travel and emissions impacts of TCMs 17 and 20 should be roughly additive.

Travel and Emissions Analysis:

A two-part analysis was used to estimate the impacts of a regional telecommuting initiative:

(1) Potential for Telecommuting in Regional Employment Base

Regional employment (Pennsylvania sector) was distributed by SIC code. Based on national telecommuting studies and application of judgement, an assessment was made of the potential of each SIC group to support telecommuting. This assessment, which is detailed in Table 4, suggests the percentage of employers in the SIC group who "could" implement telecommute based on the characteristics of their activities and the reasonableness of conducting their functions through employees who are not on-site, even for a portion of a week.

The following is a summary of the degree to which particular SIC groups could support Telecommuting (shows percent of employment situations in the stated group, who *could allow their employees to telecommute*):

100%: Trade Associations (SIC 86), Engineering and Mgt. Consult. Svcs. (87), Misc Services (89); this is 4.9% of regional base.

50%: Government (SIC 90); this is 12% of regional base.

25%: Finance/Investment/Real Estate (SIC 60-67), Business Services (73); this is 13.5% of the regional base.

10%: Health Services (80), Legal Services (81), Educational Services (82); this is 14% of the regional base.

None: All manufacturing, industrial and trade (SICs 01 through 59); Hotels (70); Personnel Services (72); Auto Repair (75); Movies and Amusements (78-79); Social Services (83); and Museums/Gardens (84). This non-eligible group comprises 55.6% of the regional base.

Thus, the effective potential base for telecommuting covers 15.6% of the regional employment base.

(2) Estimate Travel Changes Resulting from Telecommuting

The COMSIS TDM Model was used to translate this eligibility to actual travel changes. Drawing upon a synthesis of national experience as reported in a 1992 study by Daniel Rathbone: *Telecommuting in the United States* (ITE Journal, Dec. 1992), the following relationships were assumed:

If telecommute is offered by an employer, **32%** will actually do so.

Of those who telecommute, the average number of days per week that the employee telecommutes is **1.8 days**.

The TDM model was calibrated to include these rates. To ensure that the regional telecommute program would be independent of telecommute measures included under ETRP (TCM 17), the following additional steps were then taken:

In AVO zone 1, where no telecommuting measures were applied under ETRP, telecommuting was assumed to be offered to all eligible employees (as defined by SIC code above) regardless of size (over or under 100).

In AVO zones 2 through 4, where telecommute was assumed for employers of 100+, telecommuting was assumed to apply to all eligible employees in firms under 100, and to only 21% (100% less 79.4%) of those in firms of 100+.

The TDM model was run on the HBW trip table with the assumptions regarding telecommuting as delineated above. The resulting revised trip table was merged with total regional travel and sent to DVRPC for assignment to the 1996 no-build network. The assignment was then returned to COMSIS for estimation of emissions using the PPAQ model.

Cost Methodology:

There was no public cost of this program, except for the public sector as an employer participating in the telecommute program. It was assumed that there is a $350 private cost per telecommute employee, based upon a Federal Highway Administration study for purchase of computer equipment and accessories.

Table 4
Telecommuting Potential

SIC Code	Description	DVRPC-PA 1990 Employment	Overall Percent	Tele-commute Potential	Tele-commute % Eligible	Potential # of Tele-commuters
01-09	Agriculture	24,671	1.3	None	0.0	0
10-14	Mining	2,014	0.1	None	0.0	0
15-17	Construction	96,123	4.9	None	0.0	0
20-39	Manufacturing	278,800	14.2	None	0.0	0
40-49	Transportation	80,426	4.1	None	0.0	0
50-51	Wholesale Trade	111,695	5.7	None	0.0	0
52-59	Retail Trade	326,771	16.6	None	0.0	0
60-67	FIRE	164,600	8.4	25%	2.1	41,150
70	Hotels/Lodging	12,220	0.6	None	0.0	0
72	Prsnl. Services	18,077	0.9	None	0.0	0
73	Business Services	100,085	5.1	25%	1.3	25,021
75	Auto Repair	14,978	0.8	None	0.0	0
78	Movies	5,388	0.3	None	0.0	0
79	Amusements/Recreation	13,492	0.7	None	0.0	0
80	Health Services	188,071	9.6	10%	1.0	18,807
81	Legal Services	24,451	1.2	10%	0.1	2,445
82	Educ. Services	63,067	3.2	10%	0.3	6,307
83	Social Services	41,299	2.1	None	0.0	0
84	Musms./Gdn.	1,500	0.1	None	0.0	0
86	Mbrs. Trd. A.	33,123	1.7	100%	1.7	33,123
87	Engr. Mgt. Sv.	59,633	3.0	100%	3.0	59,633
89	Misc. Services	3,629	0.2	100%	0.2	3,629
90	*Govt. - All	235,473	12.0	50%	6.0	117,737
	*TOTALS	1,899,584	96.5		15.6	307,851
	*Ttl. Emp. (PA)	1,967,884				16.2% of TOTALS
	Office Ttl. Only	979,084				31.4% of Office Ttl.

*Govt.- All = Excludes Military
*TOTALS = Excludes Railroad Employees and Self-employed Persons
*Ttl. Emp. = Includes Railroad Employees and Self-employed Persons

21

COMPRESSED WORK WEEKS

Definition:

Compressed work weeks may be an effective way of reducing daily vehicle travel and VMT. This measure is defined as relevant employers in the Pennsylvania portion of the DVRPC region offering a shortened work week to all or some of their employees. There are numerous types of compressed work week; this test is limited to a 9/80 arrangement, where the employee works an average 9-hour day for 9 days over an 80-hour (2-week) cycle and receives the 10th day off.

Note: This measure is independent of TCM 17 (ETRP), since Compressed Work Weeks were not considered as a measure in the employer plans. Hence, this measure may be considered additive with TCM 17.

Travel and Emissions Analysis:

A two-part analysis was used to estimate the impacts of a regional 9/80 compressed work week initiative:

(1) Potential for Compressed Work Week in Regional Employment Base

Regional employment (Pennsylvania sector) was distributed by SIC code. Based on national studies and application of judgement, an assessment was made of the potential of each SIC group to support compressed work weeks. This assessment, which is detailed in Table 5, suggests the percentage of employers in the SIC group who "could" implement compressed work weeks based on the characteristics of their work and the likelihood that those functions could be performed effectively if the site were not open 5 days per week.

The following list summarizes the degree to which particular SIC groups could support Compressed Work Weeks (shows percent of employment situations in the stated group who *could allow their employees to have a compressed work week schedule*):

100%: None

50%: Trade Associations (SIC 86); this is 1.7% of regional base.

25%: Finance/Investment/Real Estate (SIC 60-67), Business Services (73); Social Services (83); Engineering and Management Services (87); Miscellaneous Services (89); and Government (SIC 90); this is 24.8% of the regional base.

10%: Personnel Services (72), Health Services (80), Legal Services (81), this is 11.7% of the regional base.

None: All manufacturing, industrial and trade (SICs 01 through 59); Hotels (70); Auto Repair (75); Movies and Amusements (78-79); Educational Services (82); and Museums/Gardens (84). This non-eligible group comprises 61.8% of the regional base.

Thus, the effective potential base for compressed work week covers **9.7%** of the regional employment base.

(2) Estimate Travel Changes Resulting from Compressed Work Weeks

The COMSIS TDM Model was used to translate this eligibility to actual travel changes. Using straight mathematics, a person who participated in a 9/80 work week would travel 10% less over a 2-week period (eliminate 1 day in 10). It was assumed that this day would be randomized by employers, i.e., that any weekday would be equally likely to be the day off (more likely to be a Monday or Friday), such that the effect on regional travel would be a 10% reduction in HBW travel on a given weekday.

Using the TDM Model, the percent eligibility was set at 9.7% and the reduction rates applied to all 1996 HBW trips with destinations in the Pennsylvania portion of the region. Evaluation of this scenario with the TDM model resulted in a revised HBW trip table which was then merged with total travel (complete regional trip table) and transmitted to DVRPC for assignment to the 1996 no-build network. The assignment was then returned to COMSIS for emissions estimation using the PPAQ model.

Cost Methodology:

This measure assumes that the effects of a compressed work week would remove single occupant commuters from the peak periods. There was no significant public capital cost of this program. The public transit operating costs and subsidies will be reduced to reflect the reduction in transit ridership.

Table 5
Compressed Work Week Potential

SIC Code	Description	DVRPC-PA 1990 Employment	Overall Percent	Compressed Work Week Potential	Compressed Work Week % Eligible	Potential # of CWW commuters
01-09	Agriculture	24,671	1.3	None	0.0	0
10-14	Mining	2,014	0.1	None	0.0	0
15-17	Construction	96,123	4.9	None	0.0	0
20-39	Manufacturing	278,800	14.2	None	0.0	0
40-49	Transportation	80,426	4.1	None	0.0	0
50-51	Wholesale Trade	111,695	5.7	None	0.0	0
52-59	Retail Trade	326,771	16.6	None	0.0	0
60-67	FIRE	164,600	8.4	25%	2.1	41,150
70	Hotels/Lodging	12,220	0.6	None	0.0	0
72	Prsnl. Services	18,077	0.9	10%	0.1	1,808
73	Busi. Services	100,085	5.1	25%	1.3	25,021
75	Auto Repair	14,978	0.8	None	0.0	0
78	Movies	5,388	0.3	None	0.0	0
79	Amsmts./Rec.	13,492	0.7	None	0.0	0
80	Health Services	188,071	9.6	10%	1.0	18,807
81	Legal Services	24,451	1.2	10%	0.1	2,445
82	Educ. Services	63,067	3.2	None	0.0	0
83	Social Services	41,299	2.1	25%	0.5	10,325
84	Musms./Gdn.	1,500	0.1	None	0.0	0
86	Mbrs. Trd. A.	33,123	1.7	50%	0.8	16,561
87	Engr. Mgt. Sv.	59,633	3.0	25%	0.8	14,908
89	Misc. Services	3,629	0.2	25%	0.0	907
90	*Govt. - All	235,473	12.0	25%	3.0	58,868
	*TOTALS	1,899,584	96.5		9.7	190,801
	*Ttl. Emp. (PA)	1,967,884				10.0% of TOTALS
	Office Ttl. Only	979,084				19.5% of Office Ttl.

*Govt.- All = Excludes Military
*TOTALS = Excludes Railroad Employees and Self-employed Persons
*Ttl. Emp. = Includes Railroad Employees and Self-employed Persons

22

PROHIBIT NEW CONSTRUCTION OF PARKING FACILITIES IN CENTER CITY

Definition:

This TCM would further constrain parking supply in the Center City by restricting the construction of any new parking downtown between now and 1996. The effect would be to reduce the overall parking ratio, thus limiting the number of vehicles which could park downtown, while also, presumably, raising the cost of parking at the remaining spaces.

Travel and Emissions Analysis:

This measure was evaluated using Sketch Planning techniques. It was assumed that the predominant effect would be in restricting parking supply such that vehicles physically could not park, thus forcing a shift to alternative modes. While such a constraint on space would likely also increase prices, there was no way to estimate what such an increase would be.

To estimate the impact on restricting parking supply relative to demand, the following analysis was performed:

- Change in employment in the Center City was estimated using Planning Area employment data from DVRPC for Planning Area 1:

  Increase in employment, Zone 1:

  1996 Employment Forecast: 288,656
  1990 Employment Actual: 287,887

  New Jobs: 769

  Interpolate jobs, 1994-96: 2/6 (769) = 254

- Calculate Vehicle Trip Demand: 24.9% x 254 = 63 new trips

  Assume that this net increase in vehicle trip demand can be met by existing parking supply. Hence, no impact is assumed from this measure.

23

LIMIT PARKING FACILITIES AT NEW SUBURBAN EMPLOYMENT SITES

Definition:

This TCM would restrict parking at new suburban employment sites to that required to satisfy the APO target under the Employer Trip Reduction Program. In and of itself, such restrictions could ensure that associated sites would meet their AVO targets, assuming spillover possibilities were limited.

Travel and Emissions Analysis:

This measure was evaluated using a sketch planning methodology to estimate the number of vehicle trips that would be eliminated by selective constraints in the supply of new parking. This estimate of trip reduction was then related to the HBW trip table through manual matrix adjustment.

The following steps were followed:

1. First, it was assumed that "suburban" parking would refer to facilities in the two outer AVO zones -- AVO 3 and AVO 4 -- established for the ETRP analysis. Geographically, this corresponds to the following counties and planning districts:

AVO Zone	County	Planning Districts
3	Delaware	13 - 18
	Chester	19
	Montgomery	30-35,37
	Bucks	46,48,50,51
4	Chester	20-29
	Montgomery	36,38-39
	Bucks	40-45,47,49

2. To approximate the increase in demand for new parking that would occur between 1994 and 1996, the increase in employment was estimated from DVRPC employment forecasts:

County	1990 Employment	1996 Employment	Change: 1994-96	Percent Increase
Delaware	230,450	237,680	2,386	1.03
Chester	197,740	206,480	2,884	1.46
Montgm.	457,449	487,508	10,020	2.19
Bucks	245,340	265,564	6,408	2.61

3. This increase in employment was used as a growth factor to estimate the increase in daily home based work trips that would occur between 1994 and 1996.

County	1996 HBW Pers. Trips	1994-6 % Increase	New P-T 1994-96
Delaware	343,474	1.03	3,537
Chester	305,861	1.46	4,466
Montgm.	694,872	2.19	15,218
Bucks	378,200	2.61	9,871

4. The increased parking demand that would be exerted by these additional HBW trips was estimated by calculating the number of vehicle trips that these person trips would generate, using current vehicle trip/person trip ratios for each county (these ratios were determined from model data at a planning district level). Increase in parking demand would be equal to 1/2 of the new daily vehicle trips:

County	Curr. VT/PT Ratio	1994-96 Per. Trips	Projected Veh. Trips	Parking Demand
Delaware	0.84	3,537	2,971	1,486
Chester	0.87	4,466	3,885	1,943
Montgm.	0.86	15,218	13,087	6,544
Bucks	0.88	9,871	8,686	4,343

5. It would then be assumed that this new parking demand would be constrained *not entirely, but to a new parking ratio that would limit parking to rates consistent with the trip reduction requirements of ETR -- namely, if ETR requires a 23.3% reduction in current vehicle trip making in these zones, then parking would need to be constrained to yield a VT/PT ratio which is 23.3% less than the current VT/PT.*

County	Constr VT/PT Ratio	Constr Parking Demand	Uncons. Parking Demand	Unmet Parking Demand	Vehicle Trip Reduction
Delaware	0.64	1,132	1,486	354	708
Chester	0.67	1,496	1,943	447	894
Montgm.	0.66	5,022	6,544	1,522	3,044
Bucks	0.67	3,306	4,343	1,037	2,074
		Total =	3,360	6,720	

6. These trip reductions were then compared to total 1996 HBW vehicle trips for each county. A *percent reduction* was calculated, and this reduction percent was used to reduce daily vehicle trips for each planning district in the respective county in the trip table. This revised trip table was then assigned to the 1996 no-build network by DVRPC, and emissions then estimated by COMSIS using PPAQ.

County	Total HBW Veh Trips	Parking Reduct.	Percent Reduct.
Delaware	288,731	708	0.25%
Chester	265,121	894	0.34%
Montgm.	596,465	3,044	0.51%
Bucks	331,191	2,074	0.63%

Cost Methodology:

This measure would restrict parking at new suburban employment sites to that required under the Employer Trip Reduction Program. In the short term, there would be no costs associated with this measure because the parking supply already exists and the local zoning regulations would have to be amended. In the long term, new construction or major renovation projects could reduce the number of required parking spaces or the development density could be increased. For the purpose of estimating a cost for this TCM, 3360 fewer parking spaces would be needed to accommodate the new suburban employment. The private capital cost savings would be $4,000 per space, amortized over twenty years at a discount rate of 8%.

24

PARKING CHARGE PAID BY ALL EMPLOYEES ARRIVING IN PRIVATE VEHICLES

Definition:

Free or subsidized employee parking at the work site is a major incentive for solo driving; placing a price on the use of that parking has been demonstrated to cause major shifts in employee use of alternative modes and/or work schedules. This TCM would test the impact of a $3 daily surcharge on parking to be paid by all regional employees.

An effort was made to define the application of this measure such that its impacts would be in addition to those attributable to the parking charges as a part of TCM 17 (ETRP). Thus, the travel and emissions impacts of TCMs 17 and 24 should be roughly additive.

Travel and Emissions Analysis:

The travel impacts of this measure were analyzed through the TDM Evaluation Model. A $3 surcharge was placed on all regional employees who commute to a Pennsylvania work site in a private vehicle, whether they drive alone, carpool or vanpool. The charge is levied on a vehicle, so while rideshare units are also charged, the price per person is reduced by the number of occupants. The $3 daily charge was deflated by a cost of living index of 0.58 to $1.74 before testing in the model.

In order to separate the impact of this surcharge from parking pricing measures applied in the ETR program (TCM 17), the following procedures were followed:

- In AVO zones 1 and 2, there was no surcharge applied under TCM 17 (ETRP). Thus the $3 daily charge ($1.74 after deflation) is applied to all private vehicle trips.
- In AVO zones 3 and 4, $3 ($1.74 in the model) is levied upon all private vehicle trips made by employees in firms under 100, since they also experienced no charge under ETRP.
- In AVO zones 3 and 4, 79.4% of all employees in firms of 100+ who travel in private vehicles are already receiving the $3 parking surcharge under ETRP, so they are exempt. However, since the charge is to be levied on all employee parking, it is now applied to the 21% previously unaffected (simulated by $0.37 to 100%). Also, all CP and VP trips by employees in these firms will now be charged $3 per vehicle trip, to be consistent with the definition of the measure (they were not being charged under ETRP).

These assumptions were related to the TDM Model, which was then run on a HBW trip table for

the Pennsylvania portion of the region. The simulation resulted in a revised HBW trip table, which was then merged with total travel to produce a revised regional trip table. This was transmitted to DVRPC for assignment to the 1996 no-build network; the assignment was then returned to COMSIS for estimation of emissions using the PPAQ model.

Cost Methodology:

The $3.00 per day parking surcharge applies to all regional employees arriving in private vehicles. The public costs include both a capital and operating transit cost for the additional riders using the same methodology used in TCMs 9, 10, and 11. The public sector also has an administrative cost of $500,000.

The private sector will collect the surcharge at a cost of $42.00 per space per year. This cost is the proportion of the ETRP cost in TCM 17 associated with the parking surcharge.

25

PARKING TAX IN THE PHILADELPHIA CBD WITH THE RATE BASED ON TIME OF DAY

Definition:

This measure was designed as a $3 parking tax to be levied on all employees parking in the Philadelphia CBD.

Travel and Emissions Analysis:

This analysis was performed through the TDM Model. A $1.74 tax ($3 deflated by 0.58) was assumed to be applied to all parking, public or private, and hence was treated as surcharge levied on all vehicle trips with destinations in Planning Area 1.

Cost Methodology:

The same methodology is used as in TCM 24 except that the surcharge applies only to employee private vehicles arriving in downtown Philadelphia. The administrative cost was assumed to be $250,000.

26

CONSTRUCT NEW PARK AND RIDE LOTS

Definition:

This TCM would construct about 7,500 new park-and-ride spaces in 22 new lots throughout the region available for carpooling or bus commuting. The lots are described below.

Reference Number	Name/ Facility	County	Demand	R/S	Bus	Rail
30	Middletown	Bucks	154	X	X	X
32	Bristol	Bucks	371	X		
33	Bensalem	Bucks	429	X		
35	Bensalem	Bucks	544	X		X
74	Bristol	Bucks	279	X	X	X
56	E. Whiteland	Chester	105	X	X	X
59	Valley	Chester	218	X	X	X
62	Westown, Thornberry	Chester	281	X		
65	Radnor	Delaware	374	X	X	X
66	Marple	Delaware	590	X	X	
67	Nether Providence	Delaware	617	X	X	X
68	Chester/Ridley	Delaware	481	X	X	X
37	Upper Moreland	Montgomery	114	X	X	
41	Montgomery	Montgomery	112	X	X	
42	Upper Dublin	Montgomery	289	X	X	
43	Plymouth	Montgomery	232	X	X	
45	Towamencin	Montgomery	115	X		
53	Limerick	Montgomery	178	X		
54	Collegeville	Montgomery	115	X	X	
55	Upper Providence	Montgomery	118	X	X	
34	Normandy	Philadelphia	662	X	X	
36	N.E. Philadelphia	Philadelphia	1145	X		
			7523			

Travel and Emissions Analysis:

The methodology adapted here differs from a pure empirical approach used in other studies because of some special conditions: (1) Preliminary detailed estimates by DVRPC of lot utilization, showing person trips from each lot to a system of 10 regional destinations; and (2) a new feature in the TDM model that allows on-line review and editing of individual trip table Origin-Destination trip flows/mode split.

The procedure used for evaluation was as follows:

1. Determine the Planning Area (District) identity of each lot location and each of the 10 destinations.

2. Using the **F10** trip table editing function in the TDM Model, access and print out the trip table information for each of the O-D pairs in #1.

3. The task is to modify the modal split in the affected O-D pairs consistent with the "demand" precipitated by the lot. The DVRPC study estimates the breakdown of demand (persons utilizing spaces) for each destination. For example, if a lot has a demand of 200 (implies utilization of 200 spaces by users, which we do not question), the DVRPC table will indicate the demand from the lot to destination *x*, which may be King of Prussia. Suppose this demand is 60 trips. The task is then to look at the trip table for the lot to King of Prussia, and modify the mode split by 60 trips to place those people into the appropriate alternative modes.

   This manipulation will be done by proportioning demand to the trips based on (1) the type of lot — transit, rideshare or mixed use; and (2) the existing mode split.

- If the lot is *transit only*, take the quoted "demand" from the DVRPC tables, double the number because the O-D tables are daily two-way, increase transit person trips by this amount, and reduce private vehicle trips in proportion to the current vehicle occupancy rate. For example, if the figures suggest a "demand" of 60, that would be 120 new transit trips for the given O-D. If the average vehicle occupancy is 1.07 for private vehicle travel (calculated by subtracting transit trips from person trips and then dividing by vehicle trips), then the 120 new transit trips would reduce vehicle trips by 120/1.07 = 112.

- If the lot is *rideshare only*, then demand will come from both drive alone and transit. First calculate transit loss: multiply current transit share (transit trips divided by person trips) times lot demand for that O-D times 2 for daily. Subtract this demand from transit trips in the trip table. Then calculate the reduction in vehicle trips: divide the residual demand (person demand minus transit demand) by 2.5 persons per vehicle, and subtract this amount from the vehicle trip total for that O-D.

- If the lot is *mixed use*, assign the demand proportionately based on current transit and auto use rates. First multiply current transit share times the stated demand times 2 for daily. Add this

to the transit total for the O-D pair. Take the remaining demand (multiplied by 2) and divide by 2.5 persons per vehicle. Subtract this vehicle trip change from the vehicle trip total in the trip table.

4. Make these changes for each affected O-D pair using the **F10** function in the TDM model. Save the revised trip tables under a different name, reflecting all the Park and Ride lots in the regional sample. Then merge these with total trips, run through assignment and proceed to emissions modeling.

Cost Methodology:

This measure would construct 7523 surface park-and-ride spaces in 22 lots. The construction cost used was $4,000 per space, which does not include any land costs. The construction was amortized over a 20-year period with an 8% discount rate. The other portion of the public cost was for the additional transit users using the methodology documented for TCMs 9, 10, and 11. The operating cost per space was assumed to be $0.50 per day. The parking is free, and therefore, there are no private costs.

EXPAND PARKING AT RAIL STATIONS

27

Definition:

This TCM would construct about 6,400 new parking spaces at rail stations throughout the region.

According to SEPTA's parking expansion program, parking will be expanded at the following stations by 1996:

Line	Station	County	# of New Spaces
R3	Yardley	Bucks	120
R3	Woodbourne	Bucks	101
R3	Langhorne	Bucks	50
R3	Neshaminy Falls	Bucks	62
R3	Trevose	Bucks	46
R3	Elwyn	Delaware	122
R3	Media	Delaware	40
R3	Moylan-Rose Valley	Delaware	26
R3	Philmont	Montgomery	76
R3	Bethayres	Montgomery	92
R3	Forest Hills	Philadelphia	60
R5	Link Belt	Bucks	250
R5	Thorndale	Chester	450
R5	Daylesford	Chester	118
R5	Devon	Chester	85
R5	Malvern	Chester	150
R5	Whitford	Chester	150
R5	Colmar	Montgomery	246
R5	Gwynedd/202	Montgomery	400
R5	Ft. Washington	Montgomery	240
R5	Ardmore	Montgomery	250
R7	Croydon	Bucks	69
R7	Cornwells Heights	Bucks	1842
R2	Baldwin/Crum Lynne	Delaware	1000
R2	Marcus Hook	Delaware	100
R6	Norristown Trans. Center	Montgomery	109
BSS	Fern Rock	Philadelphia	112

Travel and Emissions Analysis:

This measure was evaluated through the TDM Model using a technique similar to the procedure outlined for Measure 26:

1. The planning area (district) for each transit station/lot expansion was identified.

2. It was assumed that all persons using these station/park and rides had destinations in downtown Philadelphia (district 1).

3. Using the **F10** function in the TDM model, current modal split was determined between the district containing the P&R lot and the destination (district 1).

4. New transit demand is assumed to equal the number of new spaces (assume all the spaces will be utilized). Take the new transit riders from the current mode split identified in (3) in proportion to current mode split.

5. Adjust trip table elements for all affected O-Ds in the TDM model with **F10** function. Save as revised set of trip tables showing effects of the entire system of park and ride lots.

6. Merge these revised HBW trip tables with all other travel, run assignment and calculate emissions effects with PPAQ.

Cost Methodology:

This measure would construct 6400 additional parking spaces at 27 new lots. The cost methodology is the same as in TCM 26.

28

COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF AUTO WORK TRIPS WITH A LENGTH OF 5 MILES OR LESS

Definition:

This measure would determine the effectiveness of attracting a higher percentage of work trips 5 miles or less to bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. The current share of work trips made by bicycle was determined from 1990 NPTS data. In urbanized areas with a population of 1 million or more, with rail transit, the percentage of regional HBW trips made by bicycle is 0.27%. This figure concurs with findings of the National Bicycling and Walking Study: *Case Study No. 1: Reasons Why Bicycling and Walking are not Being Used More Extensively as Travel Modes.*

   An analysis of DVRPC trip distributions by trip length indicates that 36% of all HBW person trips are 5 miles or less. If we assume that all bicycle trips are 5 miles or less in length, then the bicycle share of HBW trips $\leq$ 5 miles = 0.27% $\div$ .36, or 0.75%.

2. Since specific bicycle improvement projects could not be assessed, bicycle use rates for work found in metro areas that had reasonably active bike programs, including facilities, were copied from the National Bicycling Study cited above. These areas (Tucson, Palo Alto, Seattle, Phoenix, Minneapolis, and San Diego) had an average bicycle use rate of 2.2%. The regional bicycle work trip goal was set to 2.2%, which equals 5.8% of trips under 5 miles.

3. The task is to increase bicycle trips $\leq$ 5 miles to 5.8%, less the existing rate of 0.75%, which is a net increase of 5%, or 79,185 daily bike trips.

4. All interchanges (O-D pairs) in HBW trip tables with trip lengths of 5 miles or less were selected. The number of trips and modal split was determined. The 79,185 new bicycle trips were pulled from the total person trip population above, in proportion to population.

5. Once the number of person trips for each O-D pair to be converted to bicycle is known, the trips are then further proportioned out of existing modes according to the existing share.

6. This manipulation is done for all affected O-Ds pairs, and the results are used to create new HBW trip tables. These trip tables are merged with total travel, assigned to the highway

network, and run through PPAQ for emissions.

Cost Methodology:

This measure would construct the required bicycle facilities to capture 5% of auto work trips with a length of 5 miles or less. The calculation of the capital cost of additional bicycle facilities was taken from the City of Chicago, CATS Conrail Bikeway Phase I Study, using only the engineering and construction costs. Using a 20-year amortization and an 8% discount rate, the cost per bicycle mile traveled is $0.13. The transit costs were calculated using the same methodology as in TCMs 9, 10, and 11. The private cost would include the cost of providing bicycle lockers at the place of employment. Each bicyclist would have a bike locker available at their work place. The cost of the bicycle lockers was $1,000 apiece (from CATS study), amortized over ten-years at a discount rate of 8%. Commuters will use biking as an alternate mode for only four months of a year.

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COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF ACCESS TRIPS OF 5 MILES OR LESS FOR WORK PURPOSES TO 14 SELECTED RAIL STATIONS

Definition:

This measure would determine the effectiveness of drawing a higher percentage of persons within 5 miles of a rail station to access that station by bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. Fourteen rail stations were identified which were felt to be likely candidates for access/utilization improvements directed at the bicycle mode. These stations are listed below, along with their current usage (taken from 1991 SEPTA Rail Passenger Survey):

Station	District	Inbound Boardings	% Work (Peak)	Riders Peak	New Bike Riders
Elwyn	17	329	.903	659	34
Media	17	401			
Langhorne	49	377	.908	342	17
Somerton	12	484	.935	452	23
Jenkintown	32	1082	.915	990	50
Levittown	50	456	.861	393	20
Torresdale	48	672	.945	635	32
Fox Chase	11	1050	.903	948	47
Paoli	19	1185	.908	1076	54
Bryn Mawr	34	916	.826	756	38
Overbrook	4	450	.878	395	20
Ambler	31	661	.875	579	29
East Falls	9	278	.817	617	31
Wyndmore	9	477			

The number of new bike riders shown above is multiplied by 2 to get daily bike trips.

2. The rail survey suggests that the current average bicycle access rate to these stations is about 1%. It is assumed that the share of persons within a 5 miles radius accessing the station by bicycle is increased to 5 percent of all trips. It is further assumed that improved access by bicycle will not affect the total trip mode split (to the ultimate destination) by shifting more

people to rail transit, but will only help to pull current private vehicle users out of short vehicle access trips in the vicinity of station.

3. For each station/district, all adjacent zone pairs with trip lengths of 5 miles or less were arrayed. The number of bicycle trips calculated above were extracted from current vehicle and transit trips in proportion to the person trips for each station area.

4. All of the adjustments were compiled into a single new HBW trip table, merged with total trips, assigned to the network, and run through PPAQ for emissions.

Cost Methodology:

This measure would attract 5% of work destination rail access trips $\leq$ 5 miles onto bicycles. The methodology was the same as in TCM 28, except that the bicycle lockers would be a public cost at rail stations. Again, bicycle trips will be used to access rail stations for only four months of the year.

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COMPREHENSIVE BICYCLE IMPROVEMENTS IN THE REGION THAT WOULD CAPTURE 5% OF NON-WORK TRIPS WITH A LENGTH OF 5 MILES OR LESS

Definition:

This measure would determine the effectiveness of attracting a higher percentage of non-work trips less than or equal to 5 miles to bicycle.

Travel and Emissions Analysis:

This analysis was performed using sketch planning techniques.

1. The current share of non-work bicycle trips was estimated from the 1990 NPTS data to be 0.89% for areas with a population over 1 million, with rail transit.

2. Set the goal for non-work trips. If the increase due to bicycle improvements for work trips was 1.93% (2.2% - 0.27%) regionally, and 5% for trips under 5 miles, then seek to increase non-work bicycle trips by 1.93%. (1.93% x 13,532,122 non-work person trips = 261,170 new bicycle trips).

3. These 261,170 new bicycle trips were taken entirely from district-to-district interchanges (O-D pairs) where trip lengths are 5 miles or less. The base for this manipulation is 7,741,288 trips. The 261,170 bicycle trips were taken in proportion to O-D person trips first, and then from existing modes within the O-D pair in proportion to the current mode split.

4. New regional non-work trip tables reflecting these adjustments were formulated, merged with other travel (HBW), and run through a new network assignment. The new assignments were processed with PPAQ to estimate emissions.

Cost Methodology:

This measure would attract 5% of the non-work trips with a length of 5 miles or less to bicycle. The methodology is similar to TCMs 28 and 29, except that the bicycle lockers would be privately funded and used four times per day instead of once a day. Also, non-peak transit headways and service are not adjusted to reflect a reduction in ridership since the headways are policy driven and not capacity driven. However, transit revenue is reduced to reflect a drop in ridership.

		CHANGE IN HOME-BASED WORK TRAVEL		CHANGE IN TOTAL TRAVEL		CHANGE IN TOTAL VMT	CHANGE IN EMISSIONS		
		Vehicle Trips % Change	Transit Trips % Change	Vehicle Trips % Change	Transit Trips % Change	Veh-Miles % Change	kg of VOC % Change	kg of CO % Change	kg of NO_x % Change
	1996 Base Condition 5-County PA Region Only	2,066,000 (a)	456,000 (a)	10,092,000 (a)	764,000 (a)	71,701,500 (b,c)	79,500 (b)	510,500 (b)	111,000 (b)
ID #	Test Scenario								
5	Enforce adherence to 55 mph speed limit on PA Turnpike	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-161 -0.2	-5,230 -1.0	-567 -0.5
	TRANSIT OPERATIONS								
6	Restoration of service on regional rail lines	-1,000 -0.0	1,267 0.3	-1,255 -0.0	1,998 0.3	-10,360 -0.0	-10 -0.0	-61 -0.0	-18 -0.0
7	Extension of Route 66 trackless trolley	-154 -0.0	171 0.0	-278 -0.0	364 0.0	-1,360 -0.0	-2 -0.0	-10 -0.0	-3 -0.0
8	Improvement to express service on regional rail lines	-368 -0.0	466 0.1	-505 -0.0	731 0.1	-14,752 -0.0	-14 -0.0	-87 -0.0	-26 -0.0
9	Systemwide fare reductions of 10%	-4,693 -0.2	5,505 1.2	-9,497 -0.1	13,164 1.7	-73,488 -0.1	-84 -0.1	-506 -0.1	-118 -0.1
10	Systemwide fare reductions of 20%	-8,275 -0.4	9,696 2.1	-16,762 -0.2	23,473 3.1	-144,016 -0.2	-178 -0.2	-977 -0.2	-238 -0.2
11	Systemwide fare reductions of 50%	-19,970 -1.0	23,409 5.1	-42,071 -0.4	58,884 7.7	-362,432 -0.5	-425 -0.5	-2,460 -0.5	-622 -0.6
12	Improve suburban bus service	-5,373 -0.3	6,161 1.4	-7,248 -0.1	9,216 1.2	-54,000 -0.1	-61 -0.1	-393 -0.1	-92 -0.1